a front-end controller coupled to the second plurality of back-end controllers for generating mirror sets from at least one of the disks in a third plurality of redundant arrays of disks received from the second plurality of back-end controllers, striping at least one of the disks in the third plurality of redundant arrays of disks and presenting the striped arrays as a virtual volume.

6.   (Amended)   An apparatus for providing a virtual volume, the apparatus comprising:

a first plurality of disks;

a redundant array of independent disks (RAID) engine comprising a second plurality of back-end controllers coupled to the first plurality of disks for organizing and presenting the first plurality of disks as a third plurality of RAID sets; and

a striping engine coupled to the RAID engine for receiving the third plurality of RAID sets as members, generating mirror sets from at least one of the disks in the third plurality of RAID sets from the second plurality of back-end controllers, striping at least one of the disks in the member RAID sets, and presenting the striped member RAID sets as a virtual volume.

8.   (Amended)   An apparatus for providing a virtual volume, the apparatus comprising:

a first plurality of back-end controllers, each configured to organize and present X N-member RAID sets, and each having N busses capable of supporting X+1 disks each;

a second plurality of groups of X+1 disks, wherein each disk in the group is coupled to one of the N busses associated with one of the plurality of back-end controller busses; and

a local front-end controller coupled to the plurality of back-end controllers for receiving the X N-member RAID sets as members, striping the X N-member RAID sets, and presenting the striped X N-member RAID sets as a virtual volume,

wherein the local front-end controller is configured to generate mirror sets from the RAID sets received as members from different back-end

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controllers, to stripe the mirror sets, and to present the striped mirror sets as the virtual volume.

13.   (Amended) An electronic system comprising:

a computer; and

an apparatus coupled to the computer for presenting a virtual volume to the computer, the apparatus including:

a first plurality of disks;

a second plurality of back-end controllers coupled to the first plurality of disks for organizing and presenting the first plurality of disks as a third plurality of redundant arrays of disks; and

a front-end controller coupled to the second plurality of back-end controllers for generating mirror sets from at least one of the disks in the plurality of redundant arrays of disks, and striping the third plurality of redundant arrays of disks and presenting the striped redundant arrays of disks as the virtual volume.

14.   (Amended) A method of storing data on a first plurality of disks, the method comprising:

using a second plurality of back-end controllers, organizing the first plurality of disks into a second plurality of redundant arrays of disks;

using at least one front-end controller, generating mirror sets from at least one of the disks in the second plurality of redundant arrays of disks, striping at least one of the second plurality of redundant arrays of disks together to form a virtual volume; and

writing the data to the virtual volume.

REMARKS

Amendments

The independent claims have been amended so that each independent claim requires the front end controller(s) to form mirror sets from the RAID sets received from the back-end controller(s). Applicants submit that each of the independent claims is patentably distinct from the cited references, and particularly that the independent claims cannot be rendered

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obvious by the combination of Massiglia, The RAID Book ("Massiglia") in view of U.S. Patent No. 5,611,069 to Matoba ('069 Patent).

Massiglia and the '069 Patent Teach Away From the Present Invention

The pending claims require a front end controller(s) to generate mirror sets from the plurality of RAID sets received from the back-end controllers and to stripe the plurality of mirror sets.

The Action concedes that Massiglia explicitly teaches that mirroring is performed by a lower Array Management Function, while striping is performed by a separate, upper Array Management Function. Thus, Massiglia clearly teaches away from combining these functions as required by the pending claims.

Contrary to the implicit assertion in the Action, the '069 patent does *not* teach the concept of a single controller generating mirror RAID sets and striping the mirror RAID sets. The Action cites Figure 5A, Reference 60 and column 11, lines 29-65 to support the rejection. However, a detailed inspection of the '069 patent clearly reveals that separate controllers manage the mirroring process and the striping process. Mirroring is performed by mirrored control sections 30-1 through 30-5 (Figure 1A-1B, 2; column 8, line 5 – column 9, line 3). By contrast striping is performed by the disk array control section 60, which is described in column 11. Thus, the '069 patent teaches that the striping controller is separate from the mirroring controller, which clearly teaches away from the pending claims.

In sum, both Massiglia and the '069 patent teach away from using a front end controller(s) to generate mirror sets from the plurality of RAID sets received from the back-end controllers *and* to stripe the plurality of mirror sets, as recited in each of the independent claims. Accordingly, neither Massiglia nor the '069 patent can render obvious the pending claims. *In re Geisler*, 116 F.3d 1465, 1469 (Fed. Cir. 1997).

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No Motivation To Combine

The Office Action concedes, at paragraph 8, that Massiglia fails to disclose or suggest the local front-end controller generating mirror sets from the RAID sets received from the back end controller. The Office Action turns to the '069 patent to make up for the deficiencies in Massiglia, asserting (erroneously) that the '069 patent teaches the concept of a controller generating mirror RAID sets and striping the mirror RAID sets.

The Action then concedes that Massiglia explicitly teaches that mirroring is performed by a lower Array Management Function, while striping is performed by an upper Array Management Function, and asserts that Massiglia suffers from the deficiency that failure of the lower Array Management Function would render Massiglia unable to control operation of the mirrored disks. The Action then asserts that one of skill in the art would have been motivated to combine Massiglia with the '069 patent "for the desirable purpose of improved reliability and flexibility." However, neither Massiglia nor the '069 patent recognize the particular deficiency identified in the Action or *any* deficiency in reliability and flexibility, much less propose a solution to a perceived deficiency or provide any motivation to combine Massiglia with the '069 patent to address this deficiency. Therefore, the motivation to combine cannot be derived from the references. Further, the action cites no specific reasons why one of skill in the art would combine Massiglia with the '069 patent. Both Massiglia and the '069 patent could be modified in myriad ways to "improve reliability and flexibility." The Action provides no specific motivation for combining the references.

The Cited References, Alone or in Combination, Neither Disclose Nor Suggest the Combination of Features in the Pending Claims

More importantly, even if one were to combine Massiglia with the '069 patent, the resulting combination would not yield the pending claims. As noted above, both Massiglia and the '069 patent explicitly teach *separating* the mirroring function and the striping function. The combination of Massiglia with the '069 patent cannot result in an arrangement in which a front end

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controller(s) generate mirror sets from the plurality of RAID sets received from a back-end controller(s) and strip the plurality of mirror sets, as recited in the pending claims. Therefore, Massiglia, alone or in combination with the '069 patent cannot render obvious the pending claims.

Official Notice

Applicant traverses each and every instance in which the Examiner has taken "Official Notice" and demands that the Examiner provide documentary evidence of the assertions presently supported by Official Notice. MPEP 2144.03

Conclusion

In view of all of the above, claims 1-8 and 10-20 are believed to be allowable and the case in condition for allowance which action is respectfully requested. Should the Examiner be of the opinion that a telephone conference would expedite the prosecution of this case, the Examiner is requested to contact Applicants' attorney at the telephone number listed below.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned "Version with Markings to Show Changes Made."

No fee is believed due for this submittal. However, any fee deficiency associated with this submittal may be charged to Deposit Account No. 50-1123.

Respectfully submitted,

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